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THE

RIFLE SIMPLIFIED.

BY

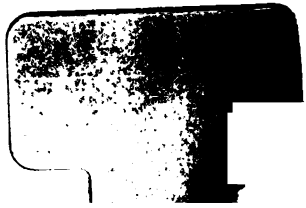
JAMES DALZIEL DOUGALL,

Author of "Shooting Simplified," etc., etc.

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THE

RIFLE SIMPLIFIED;

BEING A

FAMILIAR AND INSTRUCTIVE TREATISE

ON THAT

IMPORTANT WEAPON, AND ON ITS EFFICIENCY FOR NATIONAL DEFENCE.

BY

JAMES DALZIEL DOUGALL,

Author of "Shooting Simplified," etc., etc.

GLASGOW:
THOMAS MURRAY AND SON.
EDINBURGH: A. AND C. BLACK.
LONDON: ARTHUR HALL, VIRTUE AND CO.
1859.

2 31. c. 112.

THE RIFLE SIMPLIFIED.

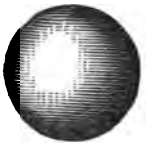
THE Science of Projectiles includes so wide and argumentative a field, and its true principles are even to this day so far from being correctly ascertained, that I shall in the following remarks avoid as much as possible theoretical or scientific disquisition. The rifle is an instrument, apparently in itself so simple, as to permit little or no room for difference in opinion. Yet it would be perhaps impossible to point out any other mechanical contrivance, on which so much variety and even antagonism of opinion exists; and I frequently have been repelled from studying the writings of authors on the subject, by their uncalled-for display of virulence towards each other. Avoiding this argumentative spirit, I shall therefore treat as clearly as I can of the leading modes of construction of this deadly weapon, and beginning at the very A B C of projectiles, endeavour to explain—

First, What a rifle is; next, In what a Minie rifle differs from, and for general military purposes excels, all other weapons hitherto invented.

I shall therefore begin by explaining what may at first appear a superfluous fact, that the whole science of projectiles is based upon one prime moving power—

Elasticity. But there is an analogy in all the modes of gaining and applying this elasticity, which is very striking and interesting, viz., That it must be comparatively slow and accumulative, propulsive in its character, and not sudden, rending, or violently explosive. This elasticity, then, we first find called into play by the action of the muscular fibre, as in throwing a stone, a dart, or combined with additional power gained by the use of a sling, which was the first implement by which such additional force was attained. And let us not, in the plenitude of our inventions, under-rate the efficiency of that simple instrument, by means of which David slew Goliath. We have the authority of Sir Archibald Alison for stating that the modern Patagonians, the inhabitants of the most southern districts of America, "mounted on their small but hardy horses, discharge their slings loaded with stones, with such address as to hit any animal at the distance of four hundred yards," *i.e.*, nearly a quarter of a mile! We again find this elasticity in the spring of wood or metal, as in the cross-bow and long-bow, the weapons of our ancestors. And, lastly, up to the present time, without taking into account Perkin's steam-gun, or that toy, the air-cane, we find this elasticity obtained from the very air itself, for gunpowder is nothing else than air in a condensed state, which is suddenly freed and expanded by combustion. Sad paradox, that constituent parts of that vital principle by which all men live, should be used for the purposes of destruction, and the giver of life be thus turned into the sender of the swift-winged messenger of death! At this point, then, we reach the first rude application of elastic air, and in the simple tube of the untutored Indian,

through which he sends his light and poisoned dart, is the germ of all fire-arms, small and great.



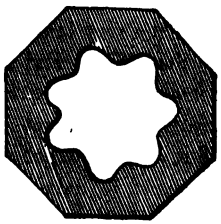
The musket ball is a sphere. This is the bullet which has been in use for centuries, and this is also that projectile with which all the comparative merits of the Minie or other balls are to be considered. A gun, under any denomination, musket, fusil, or carbine, but which is not a rifle, has the interior of the tube or barrel perfectly smooth, and from such smooth barrel this spherical ball was projected. Now, it is absolutely impossible, in the moulding or construction of this ball, to give it equal density in all its parts—some air-hole, some fault somewhere will exist. The gun is loaded and fired. The ball, acted upon by this inequality, and from irregular contact with the sides of the barrel in its passage outwards from the breech, will almost immediately begin to deflect from the line of aim, and this deflection will increase rapidly and immensely as the bullet speeds upon its way. Its action is, therefore, beyond a very close range, certainly not over one hundred yards, uncertain and capricious. Not but that its initial velocity and its power of range, except for the disturbing influence of irregularities in density, is very great; and it used to be a common saying in the army that a musket could kill at a mile's distance. To give as much force as possible to this imperfect bullet, a very heavy charge of gunpowder was used—as much, I believe, as four a-half drachms avoirdupois—the result of which, like all attempts at a cure on wrong tactics, would only be in most cases to increase the irregularity.

The calibre of this old musket was fully 11, or ·760

of an inch; the bullets were ·701 of an inch, or 14 to the lb. This disproportion was permitted for the sake of ease in loading, but it still further increased the eccentricity of the ball's flight. I remember being told by a veteran of the Peninsular war, that once on his regiment going into action, the very last man in the column was wounded by a musket ball, which must have reached him after performing some strange vagaries, to the intense astonishment of his brethren in arms. You will thus perceive that the smooth-bore gun has no power of throwing a projectile with any degree of accuracy beyond a very limited range, and I shall now proceed to explain what a rifle is.

It is now nearly four hundred years ago since an attempt was made to get quit of, or rather to make room for, the great residuum left by the combustion of the then rudely manufactured gunpowder, by means of longitudinal grooves in the interior of the gun-barrel. Like many other inventions, this failed in itself, but led to a most important and unexpected result. Whether accidentally, or by *á priori* reasoning, it struck some gunsmith that if these grooves were made, *not longitudinally*, but *spirally*, the ball would receive a rotatory motion, and thus the inequalities in its density would be compensated. The most simple and apposite illustration of the effect upon the ball of these spiral grooves is that of a boy's common spinning-top—Scottic6 *peerie*. A boy takes this top, and winds round it a piece of cord, so that, when he throws it upon the ground in such a way that the unrolling of the cord is in a direction perpendicular to the axis of the top, the latter lights upon its point, and has acquired so rapid a rotatory motion that

the laws of gravity are for a time suspended, and the top continues to revolve upon its iron-shod apex. Now this is exactly the quality imparted to the rifle ball by the spiral grooves of the barrel; and just as certainly as it would be utterly impossible, by any amount of practice or dexterity, for the boy to cause the top to stand upon its apex without rotation upon its axis, will it be impossible for the most highly-trained marksman to propel a bullet accurately from a smooth-bored barrel. A rifle, then, is a gun whose barrel has its interior divided into several depressions, termed grooves, and several parts or eminences equal to, or rather level with, its calibre, called "lands," which grooves and lands, being formed spirally, impart a spinning motion to the bullet, which continues so to spin, upon an axis coincident to its line of flight, during the whole period of that flight. Accuracy is thus gained by the transverse centre of gravity being thrown for the time being into the very axis of the bullet, so that there is no tendency to deflect from its line of aim, which is the same as that axis. Here is the muzzle of a polygrooved (*i.e.*, many grooved), rifle barrel. One might suppose, that rotation once gained, there was little or no room for further improvement, and it consequently took nearly 350 years before a further step was made, as if the mighty wars which are foretold in prophetic writ are to be fought with a means of destruction hitherto undreamt of, and whose power has already been likened by Dr Russell of the *Times* to that of "*the destroying ang*"

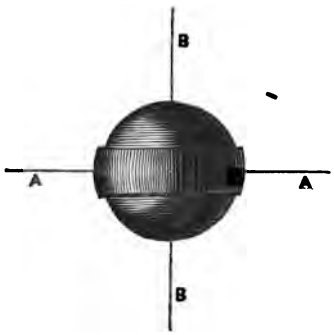


During these 350 years, war had become gradually less fatal to the combatants, and there had been a progressive diminution in the number of the killed and wounded, in proportion to the number of shots fired, in every great engagement, up to Waterloo. The chance against being hit, in proportion to the number of shots fired, had risen to nearly 500 to 1. The reason is obvious, these combatants were using a weapon in which, through its imperfections, skill in handling was of little or no avail, and training was thought useless. The sling and the bow are very imperfect instruments, but constant practice made them deadly. Few of our soldiers had ever fired a ball-cartridge until they faced the enemy. The reason why so little further improvement was made upon the rifle, and that it was so little used in warfare, depended entirely upon another element of the whole question of gunnery, viz., Facility of loading. You will at once perceive, that to receive the spinning motion, the leaden bullet must have its surface, when in contact with the barrel, expanded into and caught by the grooves. Consequently, a ball to be so caught in the grooves must be of the very largest possible dimensions, in proportion to the calibre, and must therefore be difficult to ram home at all times, and especially so after the barrel becomes foul from repeated discharges. In sporting rifles, and in target shooting, this difficulty was so far overcome by enveloping the bullet in a bit of greased cloth or leather, termed a patch, which, permitting the bullet itself to be smaller than the calibre of the barrel, at the same time was not found to hinder the ball from receiving the rotatory motion. In fact, so easily does the ball take that motion, sufficiently for a short range,

that it can be conveyed through the medium of the patch, without the lead and barrel coming into actual contact. The patch also prevented undue windage—a technical term which I shall explain further on,—and generally is so conducive to correct shooting, that in target practice it is used to envelope even the most approved Minie and other conical balls.

The next great step, then, in military rifles, was to overcome this difficulty in loading, and this was attempted by reducing the number of grooves (which formerly had varied according to taste, and without much rule, from five to thirty-three and even to a greater number) down to two, and by forming the ball so that it had a ring round it, of which the two sides bearing upon the barrel fitted into those grooves. By this means it was expected that the ball, being so formed as to mechanically fit the barrel and be caught in the grooves without forcing, would also be easily rammed home. This, then, will give you an idea of the famous and much-vaunted "Brunswick" two-grooved rifle, of which the highest expectations were at one period formed.

This woodcut gives a very correct representation of this ball. A A is the axis on which it revolves when it leaves the gun, and if the rotation remained on this axis, few bullets would excel it. But unfortunately the pressure of the air, and the



greater centrifugal force of the belt over the ball proper, change the horizontal axis to the perpendicular B B, which rotation is useless.'

This attempt proved, for military purposes, an utter failure in both respects, first as to ease in loading, and next as to great range; although for very limited ranges, say to 150 or 200 yards, it is a good ball, and I have made rifles of this construction shooting with perfect accuracy. Beyond 400 yards, which you may remember is the effective range of the Patagonian's sling, this two-grooved rifle lost all certainty, the peculiar shape of the ball leading to that entire change of its axis, from the horizontal to the perpendicular, through the resistance of the air to the sides of the projecting ring, throwing the bullet into that rotation which met with least resistance, as described above.

All spherical balls are liable to this disturbance of their axis, but the "belted ball," as it is termed, is of necessity peculiarly so, the revolution of the belt taking that direction which meets with least resistance, as I have already mentioned, and also from its natural centrifugal tendency acting upon its greatest circumference.

We have now reached a period of time something like fifteen or twenty years ago, and in projectile science a point where the most remarkable changes in its history were about to occur. I have purposely avoided the subject of the various modes of ignition, the slow-match, wheel-lock, flint, and percussion systems, which would merely take up unnecessary space in this pamphlet.

It is remarkable that all the recent improvements are

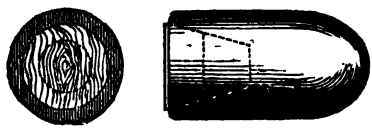
quite unconnected with, and could have been brought into use in connection with any of these modes of ignition, a fact which makes their very late invention all the more mysterious and wonderful.

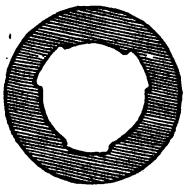
Well, the rifle being some twenty years ago still a very imperfect weapon, if viewed in its several capabilities of being easily loaded, possessing an extended range, and so forth, several inventors (and really so many seem to have had a share in the improvements, that it would be invidious to name any one in particular,) began to experiment if a ball, of a comparatively small calibre, while being loaded, could not be afterwards increased in its transverse dimensions, and so permit of easy loading under any circumstances, and yet fill up the grooves when fired. As must always happen in all true inventions, one of the regular mechanical forces was called into action, viz., THE WEDGE; and, however applied, this is the principle which governs all the expanding balls, (not the solid conical, which expand through other causes,) BUT ALL THE EXPANDING BALLS PROPERLY SO TERMED. One of these plans was to have a steel pillar in the breech of the gun, termed the rifle *à tige*, on the upper end of which the base of an elongated ball rested, and this ball was increased in its transverse proportions by a few taps of the ramrod, which necessarily shortened and widened the ductile lead. This was a good rifle, but is now obsolete.

Step by step, the great era in modern fire-arms now culminated, and the youngest reader may recollect the mingled fear and wonder with which was received the announcement, that the French Government were in possession of a weapon by which men could be struc[k]

down at 11, 12, 14, nay, at 1800 yards' distance! and that by a missile projected from a fire-arm lighter than a common musket. I happened, I may venture without self-eulogy to mention, to be the first gunmaker in Scotland, if not in Great Britain, to carefully test, and then acknowledge through the public press, the extraordinary powers of the new weapon; and for the truth of my then statements, although they were disputed at the time, Alma, Inkermann, and Balaklava, and the preservation of our Indian Empire, have borne ample and triumphant evidence. In a word, the Minie principle was given to the world, has already produced a revolution in fire-arms, will produce a revolution in military tactics, and very possibly will put an end to warfare altogether, unless nations permit themselves to be made nine-pins for tyrants to make sport with.

The Minie rifle (I shall shortly explain the slight difference between it and the Enfield) has nothing new in the nature of the barrel—it is entirely in the bullet; and that bullet again can hardly be called one, seeing it is not a ball, but a bolt. This bolt originally had in its base a depression or cavity extending fully *three-eighths* of its length. Into the mouth of this cavity was placed a *culot, i.e.*, a shallow iron cup, and were I to call it a miniature iron "saucer," I should use a quaint but correct term. This woodcut represents the bolt, as now adopted by government. The wedge is made of boxwood. The next woodcut represents the muzzle of the Enfield rifle. The whole marrow of this





great invention lies in the cavity, and its effects are readily explained. I have already spoken of the difficulty of loading, the cure of that ensued at once; but an increase of power followed beyond the most sanguine fancy, by the removal of undue windage, the nature of which I shall explain at this point, so as to more graphically convey a knowledge of what the Minie ball has done and is doing.

Windage is the difference between the diameter of the shot and the bore of the gun, permitting the passage of the air contained in a gun-barrel of any kind between the interior of the barrel and the charge. In loading a gun, it is an advantage, by permitting the charge to slip freely down; in firing a gun, it is a disadvantage and a positive loss by permitting the escape of the gases evolved by the combustion of the powder, which gases thus get in front of the bullet, derange its shape and action, and retard its velocity.

We shall now see what the Minie ball does to overcome this difficulty in both ways. The musket bullet was only equivalent to about $^{11}/_{18}$ths of the calibre of the barrel, hence the loss by windage was immense. THE MINIE BALL LOADS AS EASILY, AND OBVIATES WINDAGE IN FIRING ALTOGETHER. The Minie ball slips easily into the tube. Here, then, it has the beneficial windage. Now, when the gun is fired, the wedge, or iron cup—when there is one, for it is not essentially necessary—is driven forcibly into the cavity, the lead is swollen out, the grooves are completely filled up, *and the whole pressure of the evolved gases is kept behind.*

Besides this access of force, the ball, fitting exactly the barrel, has no room for lateral disturbance, as in the musket ball only $^{11}/_{18}$ths the size of the barrel it is fired from; and the axis of the ball being in exact accordance with the axis or longitudinal centre of the barrel, must of necessity go perfectly true to the line of aim, except such trifling variation as must arise from the imperfection of all merely human appliances, and the disturbing influences of the atmosphere.

Again, and beyond this access of force through removal of windage, another great increase of power was attained, and this last increase is now being applied to cannon, as in the Armstrong and other guns, so that you see the little Minie is the parent of all those destructive monsters, the very thought of which makes one shudder. Only think of a park of artillery on the Campsie hills sending a shower of rifled balls into the centre of Glasgow! Yet such power is already claimed for some cannon. This additional force is the decrease of atmospherical resistance, which is of course in proportion to the area of the dislodging projectile. Suppose you send through the air a ball whose size, in proportion to its weight, represents one square inch, you have therefore continually to displace a column of air of one square inch, the pressure and resistance of which is enormously and geometrically increased as you increase the velocity of the ball. Now, in the elongated projectile, you have the same weight of metal, and consequently of momentum, with vastly reduced aerial resistance, through its displacing a smaller column of air. We see the same thing exemplified in clipper ships, whose bows not only penetrate the water at a more acute angle, but

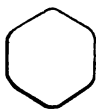
which maintain their momentum through retaining their weight by greatly extended longitudinal dimensions. Sharp bows would not alone give speed, if they be gained by reduction of the vessel's weight—there must be *vis inertiae*, or momentum, for they are convertible terms, to maintain that velocity, or, as it is termed nautically, (and we Britons all like a spice of sailor's language,) to make the ship "keep her way." You see the same in long sharp boats built for running in rowing matches, where momentum is also gained by length inordinate in proportion to breadth. The old ball, therefore, is the solid round-bowed Dutch-built craft, excellent for knocking against the short testy waves of the narrow seas; the Minie ball, and by consequence all the new Armstrong and other varieties, are the swift clipper, speeding over the ocean with formerly undreamt of velocity. The principle is one and the same in both, and strange to say, both are the invention of one age.

It is perfectly possible, for short ranges, or with rifles carefully and deliberately loaded, with all the means and appliances of greased patches, etc., etc., to produce balls vying with, possibly excelling in accuracy of aim, this hollow expanding ball; but I hope to explain sufficiently clearly its entire efficiency, and as a military weapon for regular troops, its superiority over all others—and that from three reasons—

1st, Its ease in loading, in which it has no rival whatever, except the Lancaster rifle.

2d, Its filling up the grooves through expansion, and thus gaining all the strength of the gunpowder, none of the gases escaping between the bullet and the barrel, (in other words, the doing away with windage); and

3d, The increased range of the missile through its diminished area of surface acting upon the air, and yet retaining its weight through its elongated shape. And this brings me to a fourth quality, of which I shall very shortly treat, and which will give me an appropriate opportunity to say a few words upon the ingenious invention of Mr Whitworth, an able mechanician of Manchester, who has been called upon by our Government to solve the *quaestio vexata* of rifled projectiles; for, as I have already mentioned, projectile science, even with small-arms shooting to 1800 yards, and cannon to 9000 yards, is yet in a very crude and unsatisfactory state. And really, I am not surprised that our Government, wearied with the endless contradictions and antagonism of gunmakers, should have applied to a Fellow of the Royal Society for some definite and scientific solution of the question. Mr Whitworth's plan, and it has already been most bitterly assailed, is to do away with grooves altogether, and to make the barrel a hexagon tube, and the missile a hexagon or six-sided bolt, of great length in proportion to calibre. The purpose aimed at is this—





I have already hinted that a ball, to retain its rotatory motion and give accuracy over an extended flight, must of necessity receive a great deal of rotatory power at first. The more spin the boy's top has in it, the longer it will continue to revolve on its apex. I have therefore, for simplicity, and not to crowd too many technical subjects on the reader's mind at once, deferred to this point

—the amount of spiral turn in the grooves. The Enfield governmental rifle-barrel is 39 inches long, its grooves run one-half round the barrel; in other words, its grooves form one turn of a screw of 6½ feet in pitch. I also mentioned that the elasticity needed to project missiles, must be analogous in character to the muscular fibre, comparatively slow and accumulative, not suddenly rending (it is this rending and not propulsive quality which makes gun-cotton unsuited for fire-arms). Still the force of the combustion must always be to our finite senses inconceivably rapid, and this initial rapidity of motion, if very great, causes a leaden ball to over-ride the grooves of a rifle having a quick spiral, the edges of the grooves acting as cutting instruments, and shaving or stripping the ball; and there is therefore a most decided limit to the degree of spinning motion given to the bullets, if velocity through a strong charge of powder is to be maintained, by this stripping of the ball by a rapid spiral. At the same time, the shorter the ball the less rotation is required, because the centre of gravity is the more likely to be well towards the point. The longer the ball the more rapid must be the rotation, but you get checkmated by the edges of the grooves, lying more across the barrel, shaving the lead. Some plan must therefore be adopted to give a ball of the regular weight (yet made so long as to be very narrow, and so dislodge a proportionately small quantity of air), an immensely increased rapidity of rotation, so as to maintain its spinning over a lengthened flight, because the longer the ball is, the more likely is it to topple over. Mr Whitworth here steps in and says, Why have grooves at all? Make your rifle-barrel and your rifle-bolt have a mechanical fit, and there can be no stripping,

for there shall be no cutting edges in the barrel to act upon the lead. On this principle he has boldly adopted a spiral of no less than one turn in 19 or 20 inches, so that while the Enfield rifle has only half a turn in its barrel of 39 inches, Mr Whitworth's has no less than two full turns, being exactly quadruple. He claims to have already attained a range of 2000 yards, and to make sure of hitting a mark only two inches in diameter at 500 yards; and it is said that he has asserted that he will not rest until at that distance he will make two rifles shoot their balls into each other's muzzles. I shall only say that it would be unjust to this able mechanician to criticise his theory too closely during its experimental stage. His great difficulty will be recoil, and if he overcome that, as I have every reason to think he may, his rifle will prove a wonder. His projectile weighs 1¼ ounces, its calibre is 45 spherical balls to the pound, and its length is $1^{5}/_{16}$ths of an inch, being nearly three calibres. The Enfield ball is $1^{1}/_{18}$th of an inch. I trust Mr Whitworth will overcome the difficulty of recoil. This will form the next great step in fire-arms, and is at present engaging much attention. I have recently patented an invention of my own, from which very important results are anticipated.

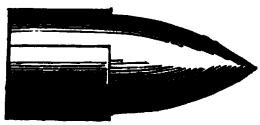
I may now explain why the once so-called Minie is now termed an Enfield rifle. The original Minie ball was found to be unnecessarily heavy, through its elongated form. Our Government therefore reduced the calibre of the rifle, introduced several improvements in the construction of the piece itself, and substituted a wooden wedge for the iron *culot*. Having also erected large works at Enfield, a few miles out of London, the name

of the place has been given to the fire-arm; but there is no radical difference between the two weapons.

The extent, excellent arrangement, and complicated machinery of these works, are truly remarkable. The machinery was imported from America, and reflects the highest credit upon the mechanical genius of our Transatlantic cousins. When I was shown over the works, by permission of the Committee of the Board of Ordnance, the machinery of the more complicated and interesting character was not yet in motion, and the bewildering chaos of wheels, springs, and levers, was a puzzle to the uninitiated eye; and whatever room there may be for reflections on some governmental management, the Enfield works, from all I have seen or heard, are a model of arrangement and ingenuity.

In the very opposite direction from the Whitworth and Enfield rifles, I shall now, out of the endless varieties ceaselessly brought before the public, describe only two more rifles, the Jacobs and the Lancaster, and I bring the two together from a desire to show that there is no dogmatic rule whatever in rifling barrels. The mere means of gaining the spinning motion is not to be compared with the proper adaptation of the barrel and missile to each other in weight, degree of spiral in barrel, and length of conical bullet. For instance, it had always been asserted that in polygrooved rifles the number of grooves should be odd, say five, seven, nine, and so on, so that a groove should always be opposite a land, by which the bullet had only to expand one-half what it would require to do if it had to expand across its diameter, in any one direction, so as to fill up a groove on each side of that diameter. General Jacobs,

a man of scientific acquirements, with a natural bent towards mechanical experimentation and investigation, spent vast sums of money in rifle practice and construction of these weapons; and he finally adopted the form of missile represented by this woodcut (A B C), with or without the steel point (D E); the barrel having four grooves, each of necessity opposite to each other. The range and accuracy of this weapon is not to be surpassed; but still, when I come to explain the superiority of the Enfield rifle over all others for general military purposes, I shall point out its disqualifications.



A B C



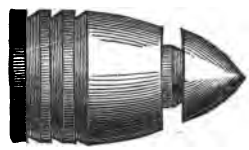
D E

The Lancaster rifle, if rifle it can properly be called, is one of the most ingenious of fire-arms. The barrel is perfectly smooth inside, and can hardly be distinguished from that of a fowling-piece; but with this difference, that it is slightly oblate or oval, not cylindrical in bore, the ellipsis passing down the barrel spirally. The degree of twist is one turn in thirty-two inches, which is the length of the barrel. The want of sharp or projecting edges of any kind, permits the easy loading of the weapon, while the very slight oblate shape of the barrel, spirally, gives the rotatory motion to the ball. It would be conceived that the same want of edges is favourable to the non-stripping of the bullet.

Breech-loading rifles are also coming into use. There are several British and American varieties of these. The best are Calisher and Terry's, and Prince's. Revolvers

may also be termed breech-loaders. The principle in all is the same, that of placing the charge at an orifice in the breech behind, so that no ramming is required, and the ball may also be of larger calibre than the barrel through which it is shot, by which windage is obviated. For shooting large animals, my own experience leads me to decide in favour of the French "Lefaucheaux" form of sporting breech-loader, being on the same principle as the fowling-piece now coming into fashion.

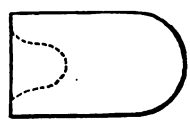
Before going into some general remarks upon taking aim, and the probable effect of the general use of rifles upon warfare, I may give representations of a few bullets by way of illustration. The annexed woodcuts show different modes of gaining expansion by wedges, the one in front, the other behind (F G and H I). The heavy obtusely pointed missile is the "Pritchett" bullet (K L), so termed after a London gunsmith, who is said to have received a large sum of money for pointing out to Government that the iron *culot* is unnecessary to create expansion, and who also designed this shape of bullet. Time and experience have not, however, so far as I am aware, led to the adoption of this form of ball in any branch of the service.



F G

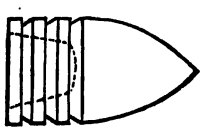


H I

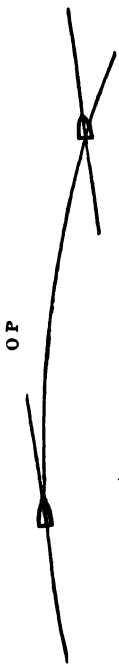


K L

The next ball (M N) is really a good one, shooting with great precision, and may be made either solid, or

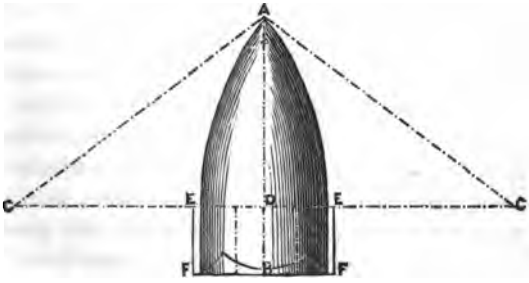


with the cavity in base, represented by the dotted lines. This is a ball designed by the American military authorities, and is termed the "Harper Ferry" bullet. The circular grooves in the cylindrical part are termed "cannelures," and serve three purposes; to diminish resistance in loading, to hold a lubricating composition of bee's-wax and tallow, and to maintain the axis of the ball in a coincidence with the line of flight. It will immediately be explained that the line of a bullet's flight is a low curve. Consequently, when the bullet ascends the first half of that curve, its point will be higher then its base, and as it has acquired a rotation upon its axis which will tend to keep it in that position, it follows, that when it descends during the latter half of the curve, it will be going in a direction oblique to its axis, and not point foremost. Here the cannelures come into use, the action of the air upon that part of them which is exposed to its resistance, (being the under part,) throwing the base upwards and keeping, therefore, the point of the bullet downwards, or in the falling curve. This diagram (O P), will more readily demonstrate my meaning. The ball is propelled to the right, and if wanting in some guiding power, cannot fly with the point forward, for that point will continue in the direction in which it first left the gun. In all balls, therefore,



with a light or acute point, and without a cavity, or, in other words, when the centre of gravity is not kept well forwards, these cannelures are advantageous and will give a low trajectory. By using a composition of bee's-wax and tallow, into which the base of the bullet is dipped while warm, the use of a patch may be superseded; but I would be cautious in advising this. I may here mention, that while patches are commonly circular in shape, and always so for spherical balls, for all conical bullets the proper shape is a square cross, the four limbs of the cross being equal. These have no superfluous cloth to gather up into folds and mar the ease of loading.

This part of my subject may serve to show how experimental or empirical the whole question of projectiles really is, and that there is not yet discovered any royal road to excellence; although, for the sake of precision, it is customary to give, in works upon rifles, some such diagrams as the annexed so as to enable the exact form of



Q R

bullet to be appreciated. The whole shape is governed by the diameter of the calibre, the length for instance being two diameters, while the degree of obtuseness or acute-

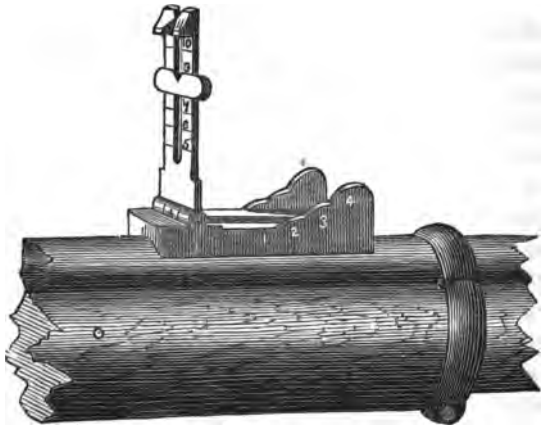
ness given to the conical part is governed by the arc of a circle drawn from the points C, which points are distant two and a-half diameters from A. The woodcut (Q R) is not mathematically correct, but will serve the purpose of illustration. Balls experimented with, and showing certain tendencies in their flight, can consequently be improved by an alteration of these proportions; and although, as I have said, there is no royal road to excellence, yet I once made a mould upon a pure problem, (which cost much thought and no small amount of figuring,) given me by a gentleman of high attainments in mathematics, which he had studied at Cambridge, which ball, without alteration or experiment of any kind, shot correctly to 800 yards. It differed in shape and proportions from any other I have seen.

I have mentioned that the "cannelures" maintain the axis of the ball in a coincidence with the line of flight, and this will now bring me, by an easy transition, to an important branch of my subject.

When a man throws a quoit, he not only gives it the necessary propulsion to send it to the required distance, but he also throws it upwards to compensate the attraction of the earth, so that the quoit's line of flight is a curve, forming part of a circle of very limited diameter. The line of flight of a rifle-ball, or any other missile projected from a fire-arm, also describes a curve, but forming part of an infinitely larger circle, and this curve is termed the "trajectory." The flatter or lower the trajectory, the more deadly is the missile, neither passing over nor under the object aimed at so readily as if that trajectory be highly curved. The swifter the ball the lower the trajectory. Upon a flight of 300 yards the highest

point of the curve will be about 40 to 45 inches from average rifles with conical balls. The American rifle-musket gives 40 inches, the Enfield rifle gives 43, which height is reached at 175 yards, so that the latter half of the ball's flight, as might be expected, is more rounded than the previous half. To gain this curve, and govern its height, a rifle is fitted with an appendage termed the "back-sight," so that by taking the aim from its elevation, in a line with a small projection at the muzzle, termed the "fore" or "muzzle" sight, the barrel is not held horizontally, but pointing slightly upwards, sending the ball not directly to the object of aim, but curving upwards. It is a most curious and interesting fact, that if no means be used to gain this curve, a projectile, fired horizontally, will reach the ground in exactly the same period of time it would have taken to fall perpendicularly from the muzzle. A cannon ball, for instance, fired without elevation, will travel a certain distance, but the duration of its flight will exactly equal its fall from the muzzle to the earth. We thus see that even gunpowder cannot nullify the laws of gravity. Experience has given a general idea of the degree of elevation for a given distance, but all rifles must be individually regulated to ensure perfect correctness, and this again will be acted upon by the state of the weather, pressure of the air, and strength of the powder used. The higher the back-sight, the lower of course will be the breech, and the higher the muzzle, so that by a graduated scale the aim is taken to suit the distance fired at. Before the invention of the Minie system I never saw any rifle sighted for more than 300 yards, though possibly some few may have been so. It

is now common to sight them to 900 and 1100 yards, the latter being the extreme distance adopted by Government. This woodcut represents that part of the barrel



of an Enfield rifle to which the sight is attached. There is a double mode of arranging the elevation, first, upon a hinge up to 400 yards, and then by raising the ladder-shaped part to the perpendicular, and shifting the moveable slide up or down. The 1100 yards' range is taken over the extreme top. Beyond that distance effective firing must be left to the judgment of the soldier, and at all ranges much will depend upon his ability to form a correct estimate of his distance. It is always better to aim rather low than high, partly because a rifle is apt to rise at the muzzle on being fired, and partly because a ball will hit the ground and *ricochet*, that is, rise again and skip as a stone does on a pool, "ducks and drake" fashion.

I have no intention of going into the minutiæ of rifle practice, there being so many Manuals now published, and will confine my remarks on taking aim to a few useful hints. The reader will observe a notch in the centre of the sight, this shape, V. At the muzzle is an upward projection, the finer the better for correct shooting. The purpose then is to bring the very centre of the above notch, the front sight, and the object of aim, all into a direct line with the eye. This is easily done, but the art is to do this simultaneously with the pull of the trigger, and also to maintain a firm command over the rifle until the discharge has taken place. Every rifle has a trick or bias, slight or considerable, which must also be mastered. To ensure good shooting, then, I offer these suggestions merely as an initiation to practice, which can alone make you a shot.

Load your rifle carefully with the proper charge of powder. Lay the patch on the muzzle, place on that your ball, and ram it home carefully. Feel that it be home; if the slightest space be left between the powder and the bullet, the latter will go untrue. The ramrod will give a solid sound when all is right. Do not strike the ramrod forcibly down on the ball, which would bruise it, and render its flight uncertain. Having capped the nipple, take your position, and gain a firm balance by extending your right foot well out and slightly backwards, throw your arms well out and upwards, so as to have the rifle pointing well up, and lying exactly even on its keel as it were, so that the sights be upright, gradually lower it, and while doing so make a slow inhalation, so that if possible the lungs be quite filled at the very instant the muzzle is passing the

bull's-eye—all the while the but-end of the gun being pressed firmly to your shoulder, the fore-finger of the right hand well bent round the trigger, so as to draw it straight back and not at all sideways, and the left hand grasping the barrel as near to the muzzle as can be done without undue straining of the muscles. The eye must be kept low and steadily into the line of sight, differing in this respect from fowling-piece firing, where the head being kept well up, and both eyes being kept open, will produce the best shooting. It does not follow, however, that the rifle cannot be shot well with both eyes open. I can shoot comparatively well either way, but it is not recommended, and the authorities of the School of Musketry are decidedly against it for military purposes. At the moment, then, that the muzzle is passing the bull's-eye, the trigger should be pulled steadily backwards (a touch does this in target shooting with a hair trigger), without any attempt at further adjustment. If you try to hold on to the aim, unless possessed of an extreme power of nerve and muscle, you will defeat your purpose, and find your muzzle wandering round the object. You need have no fear of unduly passing below the bull's-eye by the downward motion, as that will be compensated by the pull of the trigger, and the natural rise of the muzzle when the gun is fired. Some shooters raise the muzzle while taking aim, but the contrary method is the more approved. In target rifles the back sight is moveable laterally, but not in military weapons. When the rifle inclines to shoot to the right, the sight is moved to the left, and *vice versa;* in military rifles the shooter must exercise his skill after learning the bias of the gun, always allowing for the direction of the wind,

which will have a considerable influence upon the bullet. Were I inclined to go into the minutiæ of taking aim, either with fowling-piece or rifle, I believe I could explain that becoming a good shot depends upon the mental faculties, or psychological constitution. The power of abstracting the attention from every object but the coming shot, and of concentrating the whole mind upon it at the moment of firing, being greater or less, in full or weak action, will regulate the shooting powers independently of the strength of the arm or quickness of the eye. For instance, when the stomach, and sympathetically, the brain, is disordered, good shooting cannot be made. Those readers who are phrenologists will fully understand my meaning. The eye is readily trained to the merely physical action required.

Since writing the above, I am informed that the military authorities are not in favour of lowering the rifle in taking aim, but prefer raising it. This may be to secure elevation at long ranges, but the lowering system produces the best general practice up to 200 yards.

PART II.

I HARDLY know that I am quite correct in carrying into this part a comparison between the Enfield and other rifles, and I do it only because although it might have better formed part of the foregoing, yet that comparison is of an argumentative character, and will be challenged by those preferring other rifles.

Let us consider what a military rifle is. It is a weapon which shall combine the greatest number of good qualities, not sacrificing the majority of these qualities to one only, which possibly may be gained by other weapons in a higher degree. Generally, the sporting or target rifle will beat the military, being expensively made and fitted with delicate sights and hair trigger. The delicacy of the latter would unfit it for the rough shock of battle. Throwing, then, target rifles aside, let us contrast the Enfield with other claimants.

First is the WHITWORTH. Here we have the extreme of accuracy and range gained at the extreme of expense. The range is certainly enormous, according to our present ideas, yet there is no reason to suppose the highest has yet been reached. On one occasion General Hay was practising at Hythe with a Whitworth rifle, at 1850 yards, and an error having been made with the sights, the bullets passed the target on the beach, and fell out at sea beyond the reach of the eye of those at the target. The elevation was gradually lowered, and by degrees—the day being calm and the sea smooth—the bullets could be seen falling into it at great distances. Very

possibly not less than 3000 yards' range was attained. A single-barrelled Whitworth I have always understood to cost £20, and the projectiles will always be expensive. But beyond this, let us consider the probable effect, not in careful experiments, but in a campaign in all weathers, upon the fouling of a barrel with so great a degree of spiral, into whose tortuous course so exactly fitting a projectile is to be forced down. With every desire to admit the merits of this bold invention, my experience in fire-arms forces me to an unfavourable opinion of its capabilities as a military weapon.

Second is the LANCASTER. Here is another rifle of the highest claims. Whether Mr Lancaster really invented this rifle or not is a matter of little moment. The principle is old, and described many years ago. Possibly Mr Lancaster took up a crude system, experimented on and perfected it. This is a rifle easily loaded, and possessing the advantage of keeping a comparatively clean barrel. So far good, but we must view it from a military point, as adapted for general troops. Well, strange to say, it is the opinion of "Stonehenge," and other good judges, that no rifle so readily strips its ball, which consequently passes through the barrel without receiving the rotatory motion, and performs the most eccentric flights. I cannot give my personal experience of this. One thing is certain, extreme accuracy of aim is gained only by having the bullets so delicately made that they must be "swedged" after being cast. But this is a slight objection in comparison to the next, viz., the barrel not being of the due length required in the army. I am not writing of Volunteers, Sappers and Miners, or Royal Engineers, the last being now equipped, in whole or part, with

Lancaster rifles, but of troops of the line. For these the length of barrel required is 39 inches, the Lancaster being only 32. On this, then, rests a great and perhaps insuperable objection.

Third is the JACOBS. This is perhaps the most wonderful of all rifles when viewed as setting principle at defiance. For length of range it is only equalled by the Whitworth. But if the Lancaster is too long at thirty-two inches, what shall we say of the Jacobs at twenty-four or twenty-six inches? I have long ago published my opinion, (and was perhaps the very first writer on fire-arms to do so, at least I never before then saw it advanced in print,) that a short barrel gives increased velocity, and that from various reasons. In the Jacobs rifle, the vibration of the barrel is so great that no long barrel would stand it. A short, strong, thick-set barrel is absolutely necessary; and for troops of the line this settles the question. I have tested the merits of the Jacobs rifle by making one twenty-six inches in barrel, purposely for this occasion, and can vouch for its remarkable powers. A mere toy to look at, it throws a heavy ball with an accuracy beyond belief, and in the hands of volunteers and skilled marksmen, a light double gun would be invaluable. Great skill with the sights is necessary, however, because they are so near to each other as to form a comparatively obtuse angle; and rifle-shooters will understand me when I mention that taking the sight "full" or "fine" at 300 yards, makes a difference of three feet in perpendicular correctness. The inexperienced reader may best understand this by my explanation that a fine sight is when the top of the front sight only is seen through the bottom of the notch V—

the muzzle is therefore a mere shade lower than when the front sight fills up the notch, yet this slight depression, the sight at muzzle being very low and fine, sinks the ball a whole yard at 300 yards. At long ranges, then, the probability would be, in an engagement, that the balls either flew over or fell short of the enemy if drawn up in line. The Jacobs is also an expensive rifle. I should not omit mentioning, however, that a most destructive percussion-shell is fired from these rifles, with which the ammunition waggons of the enemy may be blown up at the distance of a mile. In the hands of a few picked men they would therefore be most effective weapons against artillery.

The Enfield rifle appears to me to combine the greatest number of advantages as a military fire-arm. It may be easy to find faults with, or objections to, any piece of mechanism, for nothing in this world is perfect; but what I desire to show is, that no other gun yet invented is so well adapted for general warlike purposes, meaning thereby, for being put into the hands of regular troops. This may appear contradictory to my other statement, that it is the intellectual man's weapon, but my meaning is that the soldiers must be trained up to their weapon, and intellect will always predominate in combat.

The number of grooves being only three, admits of these being shallow, so that the ball does not strip readily, while a further most ingenious adaptation is that the grooves be thrice as deep (but let the reader remember that such measurements are made by five-thousandths of an inch) at the breech as at the muzzle, so that the ball is always becoming more compressed as it leaves the barrel. This "progressive" rifling is, in my opinion, an

excellent thing, but it must not be confounded with "increasing" rifling, or spiral, which means that the grooves increase in rapidity of twist as they approach the muzzle. This is done with a view to allow the ball to start easy, without stripping, and then towards the muzzle acquire a rapid rotation. A little study will show that this is a false and delusive system.

Again, the Enfield ball being an expanding one, admits of easy loading—easy at least in comparison to other rifles, if not perfectly so. I have admitted the ease of loading the Lancaster; but if we use a bullet swedged into an oval to develop the full powers of that rifle, the loading will be affected. Again, the Enfield ball has no wings like the Jacobs, which wings must be placed in the corresponding grooves. When we hear of the Enfield not being easy to load, it just means that proper precautions have not been used. Government at first had the bullet made too large, and the grease on the cartridge was also found to make an amalgam with the lead, which consequently swelled in bulk. The button which holds the bayonet should also be removed from the barrel, to which it is at present welded, and on the inside of which the swaying of the bayonet throws up an obstruction to the ball. This may not quite suit regular troops, but is a good thing, and permits the wooden stock to strengthen the barrel to the very muzzle. Such a rifle has, at my recommendation, been selected by the Glasgow Bankers' Volunteer Rifle Corps.

It must not be forgot that the Enfield system also admits of a barrel thirty-nine inches in length. Now, this length not only gives greater accuracy in firing, and does away with the difficulty mentioned of the short

Jacobs barrel being so apt to give perpendicular aberration, but gives length of weapon for a charge, or for receiving cavalry. It must be borne in mind that the rifle is the soldier's spear as well as his fire-arm; and I am convinced that none equals the Enfield, when all the various desiderata are taken into consideration. True, the Government has wisely armed the Engineers, Sappers and Miners, and Sergeants generally, with shorter guns; but these are seldom expected to form squares or charge in line. The Volunteers' arms are also made short, partly for lightness, and also from the reason that if ever this country be invaded, they will be used as skirmishers, as which they will certainly—from the intelligence of those forming their ranks, and the vigour and bravery which ever mark the middle classes when their warlike energies are called forth—be most able defenders of their country. Still further, the comparative lightness of the Enfield ball, in proportion to calibre, owing to the cavity behind, renders unnecessary such a heavy barrel as is needed to stand, for instance, the violent vibration produced by the solid Jacobs projectile. View it which way I may, therefore, there comes always the conclusion in its favour. One objection I have heard frequently urged, that it fouls readily. This is open to every rifle whatever; while the expanding ball enters freely, and then swells out to fill the barrel, as already described, there is no cause whatever why it should foul more readily than any other rifled barrel, into the grooves of which the residuum of the powder always will be deposited, more or less. As to the other weapons being superior through their peculiar excellence, this excellence is only too delicate, and even the En-

field itself is too delicate for raw troops, and soldiers must now be educated up to their weapons.

Doubtless my readers have all heard or read disquisitions upon a nation's losing its military prowess through refinement. In other words, we are asked to believe that civilisation contains the elements of national self-destruction, and that as intellect prevails over brute force in one direction, it will be overcome by it in another. This doctrine I hold to be a libel on Divine Providence. Ancient governments fell through sloth and effeminacy, not through intellectuality, and mind will always march in advance of matter. The invention of gunpowder did much to prove this, but the real power of gunpowder has never been known until now, and the ENFIELD rifle will prove to be the *intellectual man's weapon*. Already it has been objected to as too exact and delicate for the use of rough troops, and all military authorities agree that the uneducated rough-and-ready men who principally form the material of armies, are unequal to the proper use and appreciation of nice instruments. The amount of drill, target practice, and school of musketry instruction is already increased to a great degree. And what is all this instruction for? not to teach the soldier the evolutions of a regiment, the goose step, or how to turn his eyes or his toes, but to handle a weapon which any educated man will master in a few lessons, and which weapon he will use in a fight, without throwing a shot away. Science puts into his hand an instrument whose capabilities he has but to appreciate, and call into action. This is no mere assertion on my part. I shall immediately give you good reasons for it. Not only is this rifle the intellectual man's weapon, but it is also the

patriot's weapon, and above all, the British patriot's weapon. I fearlessly assert that if ever there was any one fact in history indicative of a special preservation of these islands, such as the storms which dispersed the Spanish Armada, or those tempests which frustrated all the naval combinations of Napoleon, that special preservation may be traced in this invention. The mode of fighting with this weapon will be exactly that which suits our soldiers, and does *not happen* to suit our continental neighbours, and more, it exactly suits the defence of a cultivated and enclosed country.

The British troops alone are possessed of that individual bravery which maintains them without the pressure of masses to support their rear. Their system of arrangement and fighting on a field of battle is much more open than those of other nations. The British fight in line, two deep only—presenting a lengthened front to the enemy, and calling every rifle into use. The French troops, for instance, brave though they be, especially for a dashing but short-lived combat, are incapable of this—they attack in column, advancing perpendicularly upon their enemy's line. The great Napoleon's system of attack was something after this manner. After a long study of the enemy's position, his eagle eye detected his weakest points. Upon those points he precipitated columns of troops, with heavy artillery on each side. Regardless of the lives of his men, he reasoned thus:—"At eleven, twelve, or one o'clock, or other hour as it may be, I shall place so many men on such a position; in doing so I shall lose 5000, but 30,000 will remain. At the same hour my cavalry shall reach the same point by

a detour." He thus generally contrived to divide his enemy's armies, to throw a superior body of men upon one of his divisions, and so to beat him in detail. Even under the then inferior gunnery, the loss of life to his troops was immense; the head of the columns used to melt away like snow beneath the sun. But the pressure came on from behind—there was no retreating. The point of the wedge might be shattered, but the mass was riven. So great was the loss of life, that every bulletin was falsified, and France to this day deplores and suffers from these wasting wars of Napoleon, which drained her, first of manhood, and then of youth itself. Such a movement I believe to be now simply impossible; and from this reason, that the converging fire of opposing troops would annihilate a column advancing in close ranks, as in fact they must advance. Both armies may wield the same weapons; but I beg you to observe this great fact, that in close ranks, from various causes, even from the very smoke alone, correct firing from the Enfield rifle is no longer possible. It then becomes no better than the old Brown Bess, except in range, and even not so good if the enemy charge the British, (which perhaps they will think twice of before doing,) because weight tells in a charge, and the rifle is lighter than the musket. The British, fighting in more open order, have all the advantage on the side of their style, and I cannot see how continental nations are in future successfully to manœuvre against us upon a stricken field, unless they also contrive to change the military genius of their soldiers. This is no mere fancy of my own, no dream of the patriot or the enthusiast. I have submitted my views, in preparing this pamphlet, to officers of experi-

ence and celebrity, who entirely coincide with them. In the Peninsular war, where the great battles were fought in a somewhat different style, with many light troops in advance on both sides, the contest was carried on in this manner. The intervening ground, say 1000 yards between the opposing armies, was covered with the light divisions of both sides, who carried on an animated fire on each other, aided by some light artillery. Our troops used to have three light cannon, which our soldiers called "grasshoppers," on each flank, and three in the centre. Our light division generally succeeded in driving the French back upon the main body, and then made a rapid run back to their own regiments, throwing themselves into position on the flanks, fixing their bayonets as they ran, and a general charge decided the day. The bayonets never crossed; the French never once received our charge; they broke and fled. Some indeed say that for a moment bayonets crossed at Salamanca, but only for a moment. Well, I have the testimony of a veteran who combated in ten general engagements and eleven smaller fights, (one of the bravest men in the army, who took prisoner a French general with his own hand,) that he has known the light division, to which he belonged, engaged with the French light division for two hours, with hardly a man struck. You will possibly not credit the distance between these troops, (I did not until I had it corroborated by several officers,) why, only fifty yards! and this veteran gave me his opinion of the Brown Bess, that the correct range did not exceed forty yards. Where on earth did the bullets go to? Even at Waterloo, only one man was struck for every 480 shots fired!

But, you may ask, what comes of the artillery? that is

the momentous question. Now, artillery is a great power, but mark, it is greatest against close bodies of troops. A twenty-four pounder smashing through a square will, and has, cut down its thirty or forty men; but against a line it but takes its man or two men, and an Enfield bullet can do that. All this is in favour of our style of fighting, while against riflemen, properly so called, artillery is ineffective. At page 630 of "Straith on Fortifications and Artillery," I find these ominous words, "Fire slanting at a line, direct at a column; *never fire* with artillery on riflemen or single soldiers." The fact is, small arms have stolen a march on artillery, and many years may elapse before the tables are turned, and now the Enfield rifle can silence a battery. During the siege of Sebastopol, a heavy Russian battery was galling the troops in our trenches so severely, that Captain, now Colonel Alison, son of our Sheriff, the illustrious historian of Europe, received orders to silence it, if possible, with a few picked marksmen. The distance was estimated at 600 yards, and the men received orders to sight their rifles to that distance. I have Colonel Alison's personal assurance that he entirely silenced the battery in thirty minutes. Here the smaller weapon proved the master—the dwarf soon crippled the giant.

Readers of history must have observed that artillery seldom or never decides a battle. It opens the engagement, and is destructive in a rout, but it does not turn the scale of victory. Until there be some new mode of forging heavy pieces, with steam-hammers or otherwise, the improved cannon themselves will be untrustworthy and may fail at the most critical moment, for cast-iron or gun-metal, a mixture of copper and tin, will not long stand

rifling and throwing heavy shot. Armstrong's gun stands foremost at present, and its construction must be very expensive, while its action, being a breech-loader, may be easily deranged. I shall therefore take my data from the regular cannon used in battle, leaving improvements on both sides an open question, for we are not by any means to suppose that the ultimate limits of the rifle have been reached. At 800 yards cannon shot can be little depended upon; at 400 yards it becomes more certain; at 200 yards it becomes truly destructive. Canister is not effective beyond 450 yards. These are the exact distances given by the best authorities. Now the Enfield rifle is sighted to 900 yards, and is capable of execution very much beyond that distance. Artillery forms a most conspicuous mark—the horses, guns themselves, tumbrils, etc., are all conspicuous. Few men, comparatively, work the guns. Kill these men and who shall take their places? This fact is a most valuable one, and is recognised by military authorities so fully, that it is an established rule in the service that on all occasions where the issue is doubtful, the artillery destroy the carriages and abandon their guns, for this reason, that the *cannon may be replaced, but that the men cannot.* I think my readers will agree with me that here is a great element in the question of an attempt at invasion, viz., the heavy, expensive, yet necessary artillery, rendered useless by the small but scientific rifle.

A charge of cavalry is a dreadful affair if successful, and must be ever most destructive to volunteer troops who may fail to form in square. Let us see how the question is affected by this branch of warfare, so interesting at this juncture.

The distance at which cavalry ready to charge is generally drawn up, (or was before the invention of the Minie rifle, and my position is all the stronger now,) was 1000 yards. This distance is got over thus: The first 400 yards at a quick walk = 4½ minutes; the next 400 yards at a round trot = 2 minutes 3 seconds; the last 200 yards at a gallop = 30 seconds. You see how nicely time is calculated, and IT IS EVERYTHING in war. Total, 7 minutes 3 seconds. Now the most simple calculation will tell us that cavalry in charging was under the effective fire of the Brown Bess about 6 seconds only, and yet the British squares were never broken, or the enemy's cavalry otherwise successful. With the new rifle, cavalry on level ground will be under fire, during their whole charge, seven minutes three seconds; and allowing that riflemen do not form square, but stand the charge as the gallant 93rd did at Balaklava, *in line*, and fire say 3 shots only in two minutes, a regiment of 1000 strong will have sent 10,000 deadly bullets against the enemy. I have not the slightest doubt that Sir Colin Campbell calculated all this as carefully as I have done now. He knew his weapons, and he knew the men who wielded them. This was the greatest of all heroism—it was moral and physical courage combined, and both resting upon science. "I did not think it worth my while," said the cool veteran, "to form my line three deep." Cavalry cannot advance at a more rapid rate than I have mentioned, their horses would be blown. If they take up a nearer position they will be under fire. Volunteer corps, who may most readily be surprised by cavalry, should certainly be armed with revolvers. Every man would thus have five reserve shots

in his belt. This heavy armament, as I may term it, decided the Mexican war. The Americans, with their usual quick appreciation of improvements in every branch, went into action with frequently no fewer than thirty-seven shots at their disposal, viz., a rifle, and six revolvers firing six shots each. A few determined men could thus vanquish a host.

I called the Minie rifle the British patriot's weapon. Why? Because an invading army must be kept well together, and manœuvre in masses. I believe there is not in all Britain an open space, except perhaps Salisbury plain, where a large army could manœuvre; and as every house, cottage, hedge, and garden-wall would be a position of strength, lined with these deadly weapons, it seems to me that if any country gains an access of strength by this invention, we gain it in a ten-fold degree. And not only this country, but every country will be armed with a weapon *invincible in defence.*

Many may think me over-sanguine in declaring that I believe this invention will put an end to war altogether. I shall now give my reasons:—The Enfield rifle, from its exactness and delicacy, is certainly (and admittedly even by military men) the intellectual man's weapon. Now, who are your advocates of peace? certainly the most intellectual men, the leaders of opinion, who can, if need be, arm themselves with, and rapidly acquire skill in the use of, an exact and deadly fire-arm. Now, mark this, there can be no war whatever, except a civil one, without invasion. Some one nation must invade another. No whole nation ever did, or ever will invade another, and I think you will see as clearly as the light of day, that no army can have a chance of success in the invasion of

a country *whose people is armed*, unless that army equal in number the whole effective male population of that invaded country. If equal in numbers, they still have to encounter men in possession of every advantage. That is my logical position, and I challenge its impeachment. A free and enlightened people have but to refuse their sanction, through their representatives, to an aggressive war, and then to arm *themselves*, and defy invasion. I do not mean that such a course is now practicable or expedient for a commercial country like Britain, with its numerous colonies, but it is abstractly correct, and will be positively so some day. The whole tactics of war are already changed, and but the other day a new drill book was issued to the British army. Experienced officers cannot see how war is now to be waged. At a recent review of the 12th Infantry, I was most courteously invited by Col. Walter Campbell, Staff Officer of the Pensioners, to accompany him in front of the regiment, that he might explain to me the various evolutions. Our whole purpose was in reference to the Enfield rifle. Under Col. Campbell's experienced instruction, I rapidly caught the purpose of movements which might seem inexplicable to the uninitiated. Every one of these will now be more or less affected, and the Colonel, during the platoon firing, turned to me and asked, "How could any troops stand before Enfield rifles without annihilation?" Is this the secret of the sudden cessation of the Italian Campaign of 1859? Napoleon at Solferino, possibly—

> "Back recoiled, he knew not why,
> Even at the *blood* himself had *shed!*"

War will become needless massacre. File, *i.e.*, individual firing, the true test of a regiment's efficiency,

and even with all the faults of the old musket, hitherto the most destructive, will now be increased in effect—every horse, every officer, every cluster of men, will but serve as a mark. Out-lying volunteers will pour in a converging fire from great distances. To meet all this, vast efforts will be made to increase the power of artillery; but there is a limit to the powers of conveyance, and more, a limit to the powers of raising money, and an aggressively warlike nation will attempt to gain glory at the expense of bankruptcy.

One word, in conclusion, on Volunteer Corps. I hope to see them rapidly organised; for there is a mysterious heaving among the nations, auguring a political earthquake. To our young men, I would say, remember that when once enrolled, the soldier's first duty is obedience to his officers. The soldier's oath of fidelity to his colours was the most solemn a Roman could utter—the *Sacramentum*, a word yet in use, and ever before us in the common title of the most serious solemnity of the Presbyterian Church—the Sacrament. Drill must be patiently undergone, for without discipline, individual heroism is lessened in its usefulness. There must be the resolution to dare all, but also to bear all. To use a commercial phrase, there can be no limited liability in this compact. To a brave heart, add a cool judgment; if you be called into action, never throw a shot away. Animated by patriotism, by the love of truth and liberty, and not by the thirst for conquest, you may then safely leave the issue to Him who is the God of Battles.

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